



Golden State Waters Action Summit

San Francisco Bay and the World Ocean

APRIL 13-14, 2016

Final Summit Actions



Golden State Waters: San Francisco Bay and the World Ocean Summit Action Document

The waters on either side of the Golden Gate Bridge are some of the most biologically dynamic and productive in the world, hosting critical ecosystems and supporting many important industries. This inaugural Action Summit brings together top-level policy makers, government agencies, scientists, non-governmental organizations, and the private sector to identify the primary environmental challenges in the region where the Bay and ocean meet. The goal of the Summit is to develop a shared action agenda to address those challenges.

The mission of The Bay Institute is to protect, restore, and inspire conservation of San Francisco Bay and its watershed, from the Sierra to the Sea. Our Summit, *Golden State Waters: San Francisco Bay and the World Ocean*, is intended to focus on issues related to San Francisco Bay and its inter-dependence with the ocean. Those issues include: Marine Debris, Marine Protected Areas, Climate Change Adaptation, and Ocean Exploration and Technology. This is by no means a comprehensive listing or assessment of issues facing San Francisco Bay and our near-shore ocean – they should, however, be viewed as the beginning of an important conversation about San Francisco Bay, our near-shore ocean, and the challenges we face now and in the future.

The Bay Institute sought out advice from experts on each of the four issues to create summaries and actions. We believe that the final actions are important, feasible, and achievable.

Summary of Final Actions

MARINE DEBRIS

Reduce marine debris at its source; and enhance trash capture and removal to protect California waters.

- Uphold California’s statewide plastic bag ban, AB 270, which is up for a veto referendum on the November 2016 ballot.
- Support legislation to advance new product stewardship policies to keep trash from entering the marine environment.
- Support implementation of State Water Resource Control Board regulations to eliminate trash discharges to California waters.
- Educate the public about the need to use less single-use plastic and to keep trash from becoming marine debris in California waters.

MARINE PROTECTED AREAS (MPAs)

Provide sufficient support for the 14 community-based Marine Protected Area Collaboratives that are working to support California’s network of MPAs.

- Support the 14 community-based MPA Collaboratives, including sufficient funding to continue to support California’s MPA network.
- Request that the Ocean Protection Council formally acknowledge and support the critical role of the 14 MPA Collaboratives.
- Support the Statewide MPA Leadership Team’s appropriations requests to provide state leadership and collaboration with the 14 MPA Collaboratives.
- Hold an MPA Collaborative Summit the winter of 2016-2017 to synthesize statewide goals and to craft a statewide charter.

Summary of Actions, continued

CLIMATE CHANGE ADAPTATION

Initiate a comprehensive program to protect San Francisco Bay using natural processes and wetland restoration.

- Accelerate the comprehensive restoration of San Francisco Bay wetlands to improve habitat and protect infrastructure.
- Support ways to provide funding for wetland habitat restoration, particularly via Measure AA on the June Ballot.
- Support measures to improve the permitting processes for Wetland Restoration Projects.
- Improve regional collaboration and support local initiatives to advance restoration of natural processes.

EXPLORATION AND TECHNOLOGY

Facilitate exploration of our ocean resources off the Golden Gate (and beyond) with a goal to develop a baseline understanding of the resources in these waters and to better understand the threats to those resources.

- Launch a regional forum of experts from government, academia, the private sector, and non-profit organizations to develop an exploration strategy to establish a baseline understanding of the resources.
- Identify and use the most appropriate technologies for creating a baseline of knowledge of offshore resources and threats to them.
- Create a tiered approach to exploration harnessing the most effective and efficient technologies and approaches to develop the baseline.

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Listing of Experts Consulted

Sincere thanks to the many experts with whom we consulted on these topics in order for The Bay Institute to compile the above summaries and actions. This document could not have been prepared without their dedication, hard work, and willingness to share their expertise.

Marine Debris

Eben Schwartz, California Coastal Commission
Anna Cummins and Carolyn Box, 5 Gyres
Jonathan Bishop, State Water Resources Control Board
Allison Chan, Save the Bay
Miriam Gordon, Clean Water Action
Sherry Lippiatt, NOAA Marine Debris Program
Jack Macy, City of San Francisco Department of the Environment
Martin Molly, US Environmental Protection Agency
Mark Murray, Californians Against Waste
Stiv Wilson, Story of Stuff
Leslie Tamminen, Seventh Generation Advisors

Marine Protected Areas

Calla Allison, California MPA Collaborative Network
David McGuire, SharkStewards/Co-Chair Golden Gate MPA Collaborative
Paul Hobi, California MPA Collaborative Network

Climate Change Adaptation

Marc Holmes, The Bay Institute
David Lewis, Save the Bay
Warner Chabot, San Francisco Estuary Institute
Caitlin Sweeney, San Francisco Estuary Partnership

Ocean Exploration/Technology

Bruce Robison, Monterey Bay Aquarium Research Institute (MBARI)
Maria Brown, Greater Farallones National Marine Sanctuary
Dan Howard, Cordell Bank National Marine Sanctuary

Special thanks to Maggie Ostdahl, Aquarium of the Bay

Ms. Ostdahl participated in all aspects of the development of this document and the Summit, through her subject matter expertise and excellent organizational skills.

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SUMMIT TOPIC 1
TAKING ACTION TO REDUCE OR ELIMINATE MARINE DEBRIS

Marine debris, also known as marine litter, is defined by the National Oceanic and Atmospheric Administration as any persistent solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment or the Great Lakes.¹ This debris tends to accumulate within oceanic gyres and along coastlines, but it is a global issue, and an everyday problem. There is no part of the world left untouched by debris and its impacts. Marine debris is a threat to our environment, navigation safety, the economy, wildlife, and human health. Marine debris is also a preventable problem. Here we briefly summarize what is currently known about the issue, and put forth actions to **reduce** plastic pollution overall; **prevent** existing plastic pollution from entering the watershed; and further **educate** audiences as to the reasons for these initiatives

Plastic Is A Major Problem. Experts estimate that most marine debris is plastic, and the majority of marine debris originates on land.² Therefore, the focus of actions in this document is on land-based solutions. Examples of common plastic marine debris items include bags, bottles, straws, balloons, cigarette filters, polystyrene foam, food and beverage packaging, lost or discarded fishing gear, microbeads and microfibers, and other plastic fragments. Plastic does not fully biodegrade on a human timescale; rather when exposed to the elements, plastic is broken into smaller pieces through oxidation, hydrolysis, physical abrasion, and photodegradation. Microplastics (less than 5mm) make up the majority of plastic debris in the ocean by count, and their size makes them a readily mistakable food substitute for numerous animals. Plastic marine debris is carried off the California coast by wind and currents, impacting our waters; some of this plastic eventually reaches the North Pacific gyre or sinks deeper into the ocean.

Plastic pollution of our streams, rivers, bays, and coastal waters is one of the principle impacts of marine debris and presents a significant and increasing concern. Plastic marine debris impacts wildlife through ingestion, entanglement, and chemical contamination; is pervasive throughout the marine food web; and plastic both leaches, and acts as a magnifying vector for toxins.³ An average of 8.4 million metric tons (18 billion pounds) of plastic material enter the ocean environs annually;⁴ global plastic production has increased exponentially, and is projected to double again by 2050.⁵

¹ 15 CFR Part 909

² See e.g. Thiel et. al 2013. Anthropogenic marine debris in the coastal environment: a multi-year comparison between coastal waters and local shores. *Marine Pollution Bulletin* 71: 307-316.

³ Secretariat of the Convention on Biological Diversity and the Scientific and Technical Advisory Panel—GEF (2012). *Impacts of Marine Debris on Biodiversity: Current Status and Potential Solutions*, Montreal, Technical Series No. 67, 61 pages.

⁴ Jambeck et. al 2015. Plastic waste inputs from land into the ocean. *Science* 347: 768-771.

⁵ World Economic Forum 2016. *The New Plastics Economy: Rethinking the future of plastics*. Available: <http://www.weforum.org/reports/the-new-plastics-economy-rethinking-the-future-of-plastics>

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Plastic marine debris can cause injury and death to hundreds of different marine wildlife species including fish, whales, seabirds, sea turtles, and sea lions.⁶ It is also a mode of transport for non-native or invasive species, as well as environmental pollutants.⁷ Various species of invertebrates have been introduced outside their range by floating plastic debris. Because of its chemical properties, plastic concentrates and transports Persistent Organic Pollutants (POPs) including polychlorinated biphenyls (PCBs), dichlorodiphenyl trichloroethane (DDT), and dioxin. Furthermore, plastic marine debris leaches chemicals such as bisphenol A (BPA) and phthalates into the water. Finally, there is the economic impact of plastic pollution – trashed beaches can result in millions of lost tourism dollars, and California taxpayers spend at least \$400 million dollars each year towards keeping trash out of our waterways.⁸

Advancing Better Solutions: moving from cleanups and trash capture/removal to source reduction.

California has a long record of work on marine debris, beginning as early as 1985 when the first annual Coastal Cleanup Day took place along the entire length of California coastline. Prior to this event, marine debris work was largely limited to national anti-littering campaigns sponsored by the U.S. Forest Service and Keep America Beautiful/The Ad Council. Through much of the second half of the 20th century, focused work on marine debris was accomplished through ever-expanding beach cleanup programs along with education and awareness programs in schools and throughout the general public.

Beginning in the early 2000's, a growing body of information and data collected by beach cleanup volunteers and other entities catalyzed California to adopt new tools for addressing marine debris. Through application of the federal Clean Water Act and the State's Porter-Cologne Water Quality Control Act (Porter-Cologne Act), California enacted new storm water regulations that have dramatically impacted the marine debris landscape across the state. These regulations require cities and municipalities to reduce the amount of trash in the state's water bodies, with a goal of bringing the level of trash down to zero. As a result, cities have turned towards various mechanical approaches (e.g. trash capture devices within storm drain systems, and increased street sweeping) to prevent trash from entering the storm water system.

In addition to mechanical prevention, storm water regulations have helped lead cities and counties to evaluate other regulations in order to reduce some of the most difficult-to-manage forms of trash littering our streets. Since 2006, the state has seen a dramatic increase in the

⁶ NOAA 2014. Report on the Entanglement of Marine Species in Marine Debris with an Emphasis on Species in the United States. Available: <http://marinedebris.noaa.gov/reports-and-technical-memos>

⁷ California Ocean Science Trust 2011. Plastic Debris in the California Marine Ecosystem: A Summary of Current Research, Solution Strategies and Data Gaps. Available: <http://www.opc.ca.gov/2011/10/plastic-debris-in-the-marine-environment/>

⁸ NRDC 2013. Waste in our Water. Report prepared by Kier Associates. Available: http://docs.nrdc.org/oceans/files/oce_13082701a.pdf

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number of municipalities with product bans placed on individual types of debris. The most common among this patchwork of ordinances have been bans or fees on plastic grocery bags (now covering 146 cities and counties); and bans on expanded polystyrene food ware, known more commonly as Styrofoam (now covering 83 cities and counties).

Despite these more recent moves to remove trash from waterways, or capture it before it enters the watershed, California's history of combatting marine debris has focused largely on increasing education and awareness of the issue. While successful in many ways, these efforts cannot keep up with the rising tide of marine debris, or the exponential increases in the production of single use plastic packaging. Improvements to trash capture and removal efforts must continue, since trash will continue to become marine debris for the foreseeable future. However, an increased focus on source reduction would provide enormous advantages to the state, both in terms of increased benefits to the long-term health of our coast and ocean, as well as reduced costs associated with the prevention and cleanup of marine debris once it has entered the environment.

**POLICY ACTIONS TO ADDRESS MARINE DEBRIS
IN SAN FRANCISCO BAY AND BEYOND**

Action 1: REDUCE MARINE DEBRIS AT ITS SOURCE

In order to best address plastic pollution, we must focus on the source of the problem, the generation of poorly designed plastics – specifically single-use disposables. Plastic products that are designed without good systems for recovery in place are easily lost in the environment. Plastic products, on the other hand, that are designed as part of a circular economy with recovery and recycling factored into the design, are less likely to become pollution. Our most important efforts must be to significantly reduce the amount of single-use plastic that is produced in the first place, which is the most efficient and cost-effective way to reduce the amount of plastic released into the environment.

Immediate Goal:

Uphold SB 270 – California's statewide plastic bag ban, enacted by the California State Legislature and signed into law by Governor Jerry Brown in 2014, which is up for a veto referendum on the November 2016 ballot. Over 100 local bans are in place throughout the state, but this patchwork of policies is frustrating for businesses, confusing for customers, and does an incomplete job of protecting our waterways. SB 270 was put in place after years of hearings and efforts from stakeholders to provide a reasonable and achievable way to keep plastic bags out of our creeks, bays, beaches, and ocean waters. The statewide Plastic Bag ban should be upheld and fully implemented.

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Long-term Goal:

Support legislation to advance new product stewardship policies, e.g. Extended Producer Responsibility (EPR), with a focus on products known to become marine debris, i.e. cigarette butts, straws, takeaway food containers, and so on. Plastic is the primary marine debris material, and EPR will enable shared responsibility for plastic pollution among producers, consumers, and government. In the long run, California requires a system in which producers of goods share responsibility for the capture and take back of those items. Such a system can provide valuable incentives for ingredient disclosure, product innovation, end-of-life takeback, and reuse/recycling. California should evaluate extensions of the state's Beverage Container Recycling Law to include other plastics commonly found in marine debris; and consider and learn from existing producer responsibility rules to create and implement a well-structured EPR system, one which places value on resources that would otherwise be thrown away or lost to the environment, and helps influence producer responsibility throughout the nation.

Action 2: ENHANCE TRASH CAPTURE AND REMOVAL TO PREVENT MARINE DEBRIS IN STREAMS, BAYS, AND COASTAL WATERS

Source reduction is critical to achieving the goal of zero debris entering California's ocean, but litter will remain inevitable for the foreseeable future, even if the overall amount is reduced. There is and will be a continued need to prevent debris from escaping to the ocean. Prevention efforts need to be supported and enhanced.

Immediate Goal:

Support and enhance implementation of State Water Resource Control Board regulations to eliminate trash discharges to California waters. This recently updated trash policy promotes statewide consistency on dealing with aquatic trash pollution and provides a phased implementation plan to eliminate discharges of trash in California's waters by 2026-2030. The policy requires that all stormwater permits be modified to include trash provisions, and requires planning and specific actions by regional boards and municipalities within the next 18 months. Regional discretion is allowed for identifying other high priority land uses or other significant local non-point sources. These permits need public support and participation for as broad an application as possible within the regulated municipalities. There should be emphasis on completing implementation and verifying compliance in regions where significant work has been done to improve regional permits, such as Los Angeles and San Francisco Bay, and to share lessons learned with other municipalities around the state. The regulated municipalities also need to be encouraged to dedicate increased funding towards meeting permit requirements within or ahead of the deadlines.

Long-Term Goal:

Educate the public about the need to use less single-use plastic and to keep trash from becoming marine debris in streams, bays, and coastal waters. Environmental education and outreach programs on the impacts of plastics should continue through expanded watershed-based cleanup programs along both coastal and inland shorelines, with an increased emphasis

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on debris data collection and reporting. Multiple organizations throughout the Bay Area run cleanups, but common data protocols and a shared understanding of regional trash baselines would support a more informed public, as well as monitoring requirements to determine effectiveness of trash capture and removal systems.

INCREASE FUNDING; ADDRESS CROSS-CUTTING CHALLENGES

Critical to the above actions will be comprehensive support from both public and private sources for new and existing programs. Businesses play a critical role in the success of new and existing initiatives to combat litter and marine debris. Businesses also have much to gain from clean streets and a clean coast, as significant tourism dollars can be influenced by the cleanliness (or otherwise) of neighborhoods in which they do business.

Different municipalities and organizations have implemented various ideas to enlist business support for reduction in litter and marine debris. For example, the City of Oakland enacted an Excess Litter Fee on Fast Food Businesses, Convenience Markets, Gasoline Station Markets, and Liquor Stores. For the purpose of creating and maintaining safe, clean and sanitary streets, sidewalks, and public spaces, the city assesses a fee on businesses known to generate particularly high amounts of disposable materials that end up as trash and litter on the streets. A similar model is the Business Improvement District, in which businesses within a designated area contribute funds to help supplement activities, such as street sweeping, that cities are not able to perform adequately due to limited resources.

We support a similar, Bay Area-wide program in which businesses contribute to a fund that can help supplement existing funding sources in order to better meet the goals outlined above. Prioritization should be given for cleanup and trash capture programs, as they support reduction, prevention, and education goals, and help provide the data necessary to evaluate existing reduction efforts while helping to identify emerging issues of concern. We have also identified the following specific entities that will require support:

- CalRecycle - for development and oversight of EPR activities, especially those focused on items that are most likely to become water-borne litter and marine debris.
- Municipalities – for trash capture devices and increased street sweeping needed to comply with statewide storm water regulations.
- Other state and local agencies – for increased enforcement and waste management activities.

SUMMIT TOPIC 2
TAKING ACTION TO SUPPORT THE SUCCESS OF
CALIFORNIA'S MARINE PROTECTED AREAS

California's Marine Protected Areas. California's Marine Protected Areas (MPAs) are marine or estuarine areas in State waters with regulations in place that protect a diversity and abundance of marine species, the habitats they depend on, and the integrity of marine ecosystems. These critical areas, to quote Dr. Sylvia Earle, "represent a real hope to restore the health of our imperiled ocean." Scientific monitoring shows that protecting the ocean works: in California's Channel Islands, where protections have been in place for 13 years, sea life has been shown to be larger and more abundant inside of these reserves. More sea life within marine reserves and other protected areas will likely result in benefits to areas outside, supporting sustainability of marine life and contributing to overall ocean health.

Background – California's Marine Protected Areas

The Marine Life Protection Act, passed into law in 1999, established six goals for creating a statewide network of Marine Protected Areas:

1. To protect the natural diversity and abundance of marine life, and the structure, function, and integrity of marine ecosystems.
2. To help sustain, conserve, and protect marine life populations, including those of economic value, and rebuild those that are depleted.
3. To improve recreational, educational, and study opportunities provided by marine ecosystems that are subject to minimal human disturbance, and to manage these uses in a manner consistent with protecting biodiversity.
4. To protect marine natural heritage, including protection of representative and unique marine life habitats in California waters for their intrinsic value.
5. To ensure that California's MPAs have clearly defined objectives, effective management measures, and adequate enforcement, and are based on sound scientific guidelines.
6. To ensure that the state's MPAs are designed and managed, to the extent possible, as a network.

With the above goals in mind, California embarked on an unprecedented ten-year designation process that gathered stakeholders, area experts, and scientists from diverse backgrounds to discuss and determine the most agreeable location, size, and protection level for each MPA. In 2012, California successfully established the nation's largest statewide network of 124 Marine Protected Areas. After engaging thousands of Californians in developing a robust protection network with minimal impacts, the next challenge was to keep stakeholders engaged to ensure effective stewardship of MPAs. The focus of implementing California's network of MPAs shifted from the first four goals above to goals five and six. This endeavor required support from the same area experts, agency representatives, and stakeholders that made the designation

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process successful. Thus the MPA Collaborative Network was born.

The MPA Collaborative Network

The MPA Collaborative Network was created in 2012 to give stakeholders and local agencies an active voice in the ongoing stewardship and management of California's MPA network. Fourteen county-based MPA Collaborative groups were initiated, covering the entire coast. Collaborative Network Director and founder Calla Allison worked with the Resources Legacy Foundation to establish a pilot funding program offering \$10,000 grants to each collaborative to establish themselves and to begin work on projects to raise local awareness of MPAs and assist in their implementation.

Developed in close partnership with the Department of Fish and Wildlife, Ocean Protection Council, and local stakeholders, MPA Collaboratives bring together community members from all walks of life: marine scientists and reserve managers join fishermen, tribal representatives, environmental non-profit members, and agency staff. The goal of each collaborative is to work together on identifying and addressing local issues facing Marine Protected Areas and share resources and information for successful stewardship. Together, they propose and carry out a variety of projects including locally generated brochures, enforcement trainings, signage projects, and educational videos focusing on specific areas of the coast.

These Collaboratives are particularly valuable in enhancing local understanding and contributing to effective management and implementation of MPAs along California's long and diverse coast. By engaging local stakeholders, the Collaborative Network links statewide initiatives to local realities. The Collaborative Network has been recognized as a crucial element of the state's MPA management program, and comprises part of the MPA Statewide Leadership Team. In *The California Collaborative Approach: Marine Protected Areas Partnership Plan*, Collaboratives are recognized as "an opportunity (for the State) to engage, support, and learn from the efforts of the unique and regionally diverse stakeholders...building on and amplifying the existing energy and momentum at the local scale."

The statewide network of Collaboratives is in place and operational, yet there are significant challenges to ensuring that each Collaborative, and the network as a whole, are sustainable. Collaborative projects are organized and staffed voluntarily by members who take on Collaborative work assignments in addition to their full-time responsibilities, and with few additional resources. Currently, available funding is insufficient to sustain these community-based Collaboratives long into the future. It takes years, probably decades, for ocean resources within MPAs to rebound, which emphasizes the importance of the Collaborative members to provide on-the-ground education, outreach, and enforcement to ensure success. While the engagement of hundreds of members statewide illustrates an early success in the localized collaborative approach, a clear strategic approach is needed to maintain long-term support for the Collaboratives, and to coordinate their work with the State of California and the rest of the Collaborative Network.

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The Golden Gate MPA Collaborative

The *Golden Gate Marine Protected Area Collaborative* has made significant progress raising the profile of local MPAs. Its co-chairs, Brian Baird of The Bay Institute and David McGuire of Shark Stewards, have worked on MPAs, marine conservation, and resource management for years. Because of the connection of these MPAs to the ecological processes of San Francisco Bay (the largest estuary on the west coast), it was decided that the Collaborative should cover the waters off of two counties in the “Golden Gate” area – San Francisco and Marin. The Collaborative successfully applied for \$10,000 to support the organization of the group and to initiate projects to help with education, outreach, and advocacy for the successful implementation of the MPAs off this coastline.

Members of the Golden Gate MPA Collaborative include U.S. Fish and Wildlife, Aquarium of the Bay, Sonoma State University, Surfrider, Audubon, Coastal Commission, California Academy of Sciences, Marin Environmental Action Committee, Greater Farallones National Marine Sanctuary Association, The Marine Mammal Center, Point Reyes National Park Service, Point Blue, NOAA, Reefcheck, Romberg Tiburon Center for Environmental Studies, Sierra Club, Shark Stewards, County of Marin, Golden Gate Parks Conservancy, SF Department of the Environment, NRDC, and others. The Golden Gate MPA Collaborative oversees MPAs from Point Reyes to the north to Devils Slide in the south, and the Farallon Islands to the west. However, it also coordinates with members of the Collaboratives up and down the coast.

Golden Gate MPA Collaborative: An Action Case Study

Although MPAs were created through a highly visible process, most members of the public are not aware that they exist, what they are intended to accomplish, or what restrictions may apply. This is complicated by the fact that many of the MPAs in the Golden Gate region are located either far offshore or in relatively remote areas of the coastline. Therefore the community and Golden Gate MPA Collaborative members have worked together to produce the following products and programs:

- **America’s Cup Healthy Ocean Project Pledge.** During the America’s Cup Race series in San Francisco, a pledge was circulated by Aquarium of the Bay and Dr. Sylvia Earle seeking support for the implementation of the MPA network, both locally and throughout the State. People from 23 states and 34 countries pledged their support for California’s network of Marine Protected Areas. Although this effort took place before the Collaborative was formally created, it involved most of the same participants and provided an important foundation for the Golden Gate Collaborative, as well as other Collaboratives throughout the State.
- **An educational video about MPAs, shown daily at Aquarium of the Bay:** The Bay Institute and Aquarium of the Bay worked with the Department of Fish and Wildlife, the Ocean Conservancy, a private public relations firm, and a filmmaker to produce this

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video, which features children learning about MPAs and why they are important.

- **A map-based brochure outlining the geographical boundaries and regulations of MPAs off the coasts of San Francisco and Marin counties:** This was developed at the request of the Collaborative community with an emphasis on simplicity and readability. Golden Gate MPA Collaborative members convened meetings with a variety of interests, including local boat captains and enforcement officers, focusing on the needs of boaters visiting the Farallon islands (where most MPA violations in the region occur). The final product, an effective, waterproof brochure, is now being distributed by partner organizations in various locations throughout the San Francisco Bay Area.
- **An MPA Ambassador Program:** The Golden Gate MPA Collaborative has established a program of Ambassadors to help spread the word about MPAs. Some are highly trained about the specifics of MPAs and others are members of the public who want to act as local stewards and MPA messengers. To date, GGMPAC has a total of approximately 200 Ambassadors with a goal to increase that number to 1,000 by the end of 2016.
- **Community Outreach Programs:** Collaborative members have put on, or participated in, approximately 20 public events educating on MPAs. The Bay Institute put on twelve Film and Lecture Series events that addressed MPAs. Other public outreach events were held at Aquarium of the Bay, Sea Lion Center, Bay Model Visitor Center, California Academy of Sciences, San Francisco Waterfront Sharktoberfest events, Jack London Square Boat Show, and a recent meeting of Harbor Masters in ports that are heavily used by offshore fishermen.
- **MPA Watch and Beach Watch:** MPA Awareness training has been incorporated into the MPA watch program implemented at Point Reyes by the West Marin Environmental Action Committee and the Point Reyes National Seashore. MPA training is also provided to Beach Watch volunteers by the Greater Farallones National Marine Sanctuary and California Academy of Sciences. Both programs are field oriented naturalist programs that collect data and educate the public in and around MPAs and other beaches in the region.
- **Harbor Signage:** The majority of boat-based MPA violations at the Farallon Islands come from two harbors in San Francisco Bay: Richmond and Berkeley. The Golden Gate MPA Collaborative is working with harbormasters and the Department of Fish and Wildlife to install MPA signage geared towards boaters, to increase awareness and compliance.

Early Results: The Golden Gate MPA Collaborative's work has proven extremely effective in raising awareness and building partnerships that have enhanced enforcement of local MPAs. In

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early meetings of the Collaborative, Farallon Islands biologists and reserve managers opened lines of communication with California Department of Fish and Wildlife Wardens. They began reporting MPA violations at the islands using an online system that alerted wardens waiting in San Francisco Bay, who then contacted violators, issuing warnings and sometimes citations. Wardens are now able to enforce MPA regulations much more efficiently in partnership with Farallon Islands staff. Collaborative members have handed out brochures and cultivated a group of fishing and whale watching boat captains and other stakeholders who are acting as MPA Ambassadors on the water, raising awareness about MPAs and handing out materials.

Ongoing Challenges and the Future: The activities of the Golden Gate MPA Collaborative have been impressive to date, but the Collaborative is operating almost entirely on volunteer efforts. In the coming year, this Collaborative, as well as the other 13 California Collaboratives, will be developing an enhanced strategic vision for the future, which will include taking a hard look at the support needed for ongoing efforts. Currently, the Golden Gate MPA Collaborative lacks the long-term funding and support necessary to maintain and enhance this community-based approach. Additionally, the Collaborative recognizes that it's time to coordinate with the other 13 Collaboratives along the coast to discuss the statewide vision of the Collaborative Network as well as share lessons learned, innovative approaches, and what we want to achieve in the years ahead.

POLICY ACTIONS TO SUPPORT MPAs

The following immediate and long-term actions are intended to help implement Marine Protected Areas (MPAs) off the San Francisco and Marin County coastlines and throughout the state of California.

Action 1: Provide sufficient support for the network of 14 Marine Protected Area Collaboratives along the California Coast, so they can provide long-term community engagement and stewardship for California's network of Marine Protected Areas.

Collaborative stewardship, using a countywide-based approach, is proving to be an effective way to assist on-the-ground implementation of California's MPAs. While agencies of all levels, academia, non-profits, and ocean industries are contributing time and resources to support the effective management of their local MPAs, there needs to be support for ongoing communication, coordination, and implementation provided by these community-based Collaboratives. This support will help coastal communities from San Diego to Crescent City to ensure the long-term success of California's network of Marine Protected Areas.

Immediate Goal:

Seek Funding and Support. The 14 Collaboratives must join together to seek funding and support from all available sources for both the short and long-term to maintain their operations. A one-time seed grant of \$280,000 would provide each Collaborative with \$20,000 to support 12 months of ongoing education and outreach services, and to assist with enforcement activities. It would also support the long-term planning identified below via a

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Summit. However, any immediate funding should be closely linked to a strategy for long-term support of the Collaborative Network.

The Collaborative Network will need to reach out to the philanthropic community, the private sector, and government sources. Ideally, public and private funders can partner together to fund the ongoing work of the Collaborative Network – an extension of the public/private partnership that was used to create California’s MPAs.

As a first step in that process, the Collaboratives should request the Ocean Protection Council to develop and pass a resolution acknowledging and supporting the critical role of these community-based organizations in implementing California’s network of Marine Protected Areas.

Secondly, the MPA Statewide Leadership Team should request the State Legislature to appropriate funds for agencies to fund their staff to participate in and lead individual Collaboratives beginning in September, 2016. This will provide a solid foundation for the institutionalization of individual Collaboratives, as well as of the Collaborative Network as a whole.

Action 2: Hold an MPA Collaborative Summit winter of 2016-2017. The 14 MPA Collaboratives should hold a Summit to synthesize statewide goals and to craft a statewide charter. The goal of the charter will be to better define how the 14 Collaboratives will work together to assist the Department of Fish and Wildlife, allied agencies, academia, the fishing community, and other stakeholders with efforts to improve the communication, coordination, and implementation of California MPAs. The charter could then be used as a basis for the resolution acknowledging and supporting the critical role of the Collaboratives in ensuring the long-term viability of California’s network of Marine Protected Areas. Additionally, this summit will assimilate resources, share lessons learned, and develop a strategy that will allow stakeholders to more effectively communicate and facilitate compliance with Marine Protected Areas.

SUMMIT TOPIC 3
TAKING ACTION TO ADAPT TO CLIMATE CHANGE

Climate change is directly threatening the health and safety of the people and wildlife of the San Francisco Bay Area. Experts predict that the impacts of climate change will continue to increase throughout the 21st century, significantly affecting our economy, infrastructure, and way of life. Climate Change is causing serious adaptation challenges, which will only increase in urgency in the coming years for the following reasons:

- **Higher Air and Water Temperatures:** Longer periods of warmer, dryer weather will increase energy use, adding to greenhouse gas emissions and further magnifying climate change. Increasing water temperatures threaten many species, such as salmon, which is both commercially important and has endangered status throughout much of its range.
- **Acidifying Waters:** Increasing water temperatures are also causing marine waters to become more acidic, which is of particular concern for shell forming species such as oysters. This could have profound adverse impacts to our marine ecosystems in both the Bay and nearshore ocean waters.
- **Less Freshwater Quality and Reliability:** Warming temperatures are bringing more intense periods of drought and flood, shrinking the Sierra Nevada snowpack, and reducing our once reliable water supplies. As sea level rises, coastal and Delta water supplies will be lost as they are tainted by salty ocean water. Extreme, unpredictable swings in weather will disrupt the food web for resident and migratory species.
- **More Flooding Caused by Extreme Storms and Sea Level Rise:** Sea level is on average eight inches higher since 1900, and will keep rising – likely at an accelerating rate – as a function of climate change. Flooding and higher storm surges around San Francisco Bay are forecasted to become much more frequent and severe in the coming decades, threatening low-lying residential communities, farmlands, roads, airports, utility services, pipelines, water treatment plants, and other coastal infrastructure.
- **Wetland Loss:** Sea level rise and a reduced sediment supply will drown tidal marshes and other shoreline habitats of San Francisco Bay, eliminating crucial habitat and reducing public access to the shoreline. Furthermore, since tidal wetlands actually help protect against flooding and storm surge, wetland loss reduces resiliency to climate change.

Implementing a Regional Action Plan to adapt to climate change

There is much to do to address greenhouse gas emissions and other factors that are fueling climate change. However, this Summit is focusing on the urgent regional challenges of adapting to climate change. Recent work conducted by numerous Bay Area organizations has identified the use of wetlands to stabilize shorelines instead of traditional concrete seawalls or earthen levees. Studies have shown that restored wetlands can protect critical infrastructure from rising seas, restore vital habitat, and be accomplished at significantly lower costs compared to traditional shoreline protection methods. Researchers are evaluating the potential benefits of incorporating natural ecosystems using strategies such as Horizontal Levees and restored natural wetlands to mitigate the harmful impacts of sea level rise. A study by The Bay Institute demonstrates that San Francisco Bay's marshes can be integrated into a low-cost and effective regional flood protection network.

Restoring wetlands will enable natural ecosystem processes to function fully. In addition to providing flood protection, Bay wetlands perform multiple functions, including removing pollutants from the water, sustaining fisheries, providing wildlife habitat, and creating wild open spaces to explore and enjoy nature.

The prescription is clear—work *with* nature, not *against* it.

Restore the San Francisco Bay wetlands ecosystem *now* to protect Bay Area communities and their environment. The Baylands Goals 2015 Science Update is a study by over 20 agencies and NGOs containing the recommendations of 200 scientists and government experts. The study advises that large-scale restoration of San Francisco Bay wetlands must be accelerated to adapt to rising sea level and other impacts of climate change. It warns that 100,000 acres of San Francisco Bay wetlands must be restored by no later than 2030 to defend the Bay's shoreline against sea level rise and to avoid extensive loss of wetlands and wildlife.

Wetlands can keep pace with rising seas only if sediment builds up along the surface of the marsh over time. Sediment in the estuary's water column is essential to grow and sustain wetlands, and there is currently a diminishing sediment supply throughout the San Francisco Bay estuary. We must manage our activities to deliver sediment and clean water to nourish marsh growth. Wetland-nourishing sediments carried by natural currents and streams can be augmented by using sediment dredged from shipping and flood control channels.

The time to act is now. By expanding and accelerating wetland restoration projects across the San Francisco Bay Area, we can make enormous progress in our efforts to reduce the harmful impacts of climate change.

POLICY ACTIONS FOR ADAPTING TO CLIMATE CHANGE

We have one overarching action, with four key policy actions that will be essential for effective climate change adaptation in the Bay Area.

Action: Initiate a comprehensive program to protect San Francisco Bay communities and ecosystems using natural processes and wetland restoration wherever feasible to promote resiliency to climate change impacts in the coming decades.

Immediate Actions:

1. **Accelerate Restoration of Bay Wetlands:** Update Federal and State policies to accelerate restoration of Bay wetlands to meet the goal of 100,000 acres by 2030. Augment delivery of clean sediment by developing and implementing a comprehensive regional sediment management plan, including a business model and incentives to increase sediment delivery to tidal wetlands and mudflats. Assign priority to dredging projects that practice “beneficial reuse” of dredged sediments.
2. **Increase Funding for Wetland Restoration:** Expand funding to meet the 2030 restoration deadline by passing Measure AA, a regional \$12 per year parcel tax proposed by the San Francisco Bay Restoration Authority. Match this local investment with state and federal funds. The US EPA provides Chesapeake Bay and Puget Sound with hundreds of millions of dollars for restoration activities. San Francisco Bay restoration activities should be funded at a comparable level.
3. **Improve Permitting for Wetland Restoration Projects:** Create a regional, multi-agency process that expedites issuance of wetland restoration permits. Improve interagency coordination to accelerate completion of the regional wetland restoration initiative, while maintaining environmental protections. Strengthen regulatory restrictions on activities that increase wetland loss and increase risk to shoreline infrastructure from climate change.
4. **Improve regional collaboration and support local initiatives to advance restoration of natural processes:** Advance local climate adaptation planning that includes protection of existing natural resources and integration of natural processes into adaptation strategies. Integrate climate adaptation into the Bay Area Sustainable Communities Strategy and provide funding to municipalities to integrate the functions of wetland processes into resiliency planning.

SUMMIT TOPIC 4
TAKING ACTION: OCEAN EXPLORATION AND TECHNOLOGY

Ocean exploration is about making discoveries, searching for new life forms and oceanic features, and learning about our past. Ocean exploration is not a random endeavor, but a disciplined and systematic undertaking that includes rigorous observations, measurements, and documentation of biological, chemical, physical, geological, and archaeological aspects of the ocean. The findings are fundamental to understanding our ocean and provide the environmental intelligence necessary to address current and emerging science and management needs. Exploration helps to ensure that ocean resources are not just managed, but managed well, so those resources are around for future generations to enjoy.⁹

Why explore the ocean?

What's left to discover? Don't we already know enough about the waters beyond the Golden Gate to measure the problems and anticipate the consequences of our actions or inactions?

We know very little about the world beneath the waves, particularly the deep ocean. Often, what we do know is a function of how we learned it. If you study the moon with a telescope you gain a certain kind of knowledge; if you walk on the moon, you acquire a very different suite of information. It's the same story in the ocean. Most of what we know about the ocean beyond the Golden Gate is gathered from fishing men and women, scientists, and sailors working from the decks of ships at the surface either gathering samples of life forms with a net, or observing the ocean surface. What does it really look like beneath the water that covers over 70% of our planet? What does it look like beyond the Golden Gate? What lives at its depths? How do our actions on land change the ocean—the source of life on our planet?

Evolution of Ocean Exploration

A revolution in marine research was generated when scuba gear gave scientists the ability to enter the habitat and study the subtidal region directly. A similar transformation is taking place in the open ocean, with the advent of undersea vehicles, both human-occupied and robotic. Undersea vehicle technology provides researchers with an unprecedented, in situ perspective. For examples of unanticipated discoveries that were made after we began to explore from a different perspective, we can look to the deep ocean.

For more than a century, our understanding of the animals living in the deep water column came from samples collected using nets, towed by a surface vessel and hauled up for delivery to the eager hands of scientists on deck. Typically, these net hauls contained mostly hard-bodied animals like fish, squid, and crustaceans. When we began to enter the deep-sea habitat

⁹ NOAA Office of Exploration and Research, NOAA Ocean Explorer website:
<http://oceanexplorer.noaa.gov/welcome.html>

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to make direct observations from undersea vehicles, everything changed. Instead of just the familiar faces from net hauls, it turned out that a huge number of soft-bodied gelatinous animals also occupy that same habitat. The problem was that the nets used to sample the deep water column destroyed the fragile jellies and gave us a skewed picture of what it was really like down there. We realize now that the biomass of the largest ecosystem on Earth had probably been underestimated by as much as a third, because of this sampling bias.

Another surprising result of deep-sea exploration was the discovery of hydrothermal vents and their remarkable communities based on chemosynthesis instead of photosynthesis. This discovery led to a paradigm shift in our understanding of fundamental life processes on Earth. Many of the regions that contain vent communities had been sampled previously with nets and acoustics, but until a submersible dropped in on one near the Galapagos, we hadn't a clue to their existence.

Exploration is crucial to the protection and management of the waters beyond the Golden Gate because there is little baseline information from which changes can be detected and assessed. The general shape and characteristics of the seabed beyond the Golden Gate has been documented by the US Geological Survey, NOAA, and the California Department of Fish and Wildlife. Local biological surveys have been made around the Farallon Islands and at Cordell Bank in collaboration with the National Marine Sanctuary program and their partners. Seafloor surveys have also been conducted by EPA, USGS, and NOAA at the former Atomic Energy Commission's radioactive waste disposal site off the Farallon Islands. A number of other studies have examined specific taxonomic groups at a few sampling sites, but for the most part these are piecemeal and inadequate to truly understand and steward our ocean backyard.

Creating a Baseline through Exploration

What's lacking is a baseline, a comprehensive survey of biological distribution patterns and relative abundances of resident species; and exploration is how we generate a baseline. Undersea technology has evolved rapidly over the last 15 to 20 years. Likewise, the methodologies for using these new tools have progressed apace. Three categories of undersea exploration vehicles are available:

- **Autonomous Undersea Vehicles (AUVs)** are pre-programmed to conduct seafloor and water column surveys without a human in the control loop. They are battery-powered and can carry sophisticated, high-resolution acoustic and optical imaging systems that are used to build 3-dimensional mosaic maps of the seafloor. Such maps provide the large-scale geological and biological context within which a baseline is compiled.
- **Remotely Operated Vehicles (ROVs)** are vehicles that operate at the end of a long tether that supplies power from a mother ship at the surface. The tether provides human operators with direct, real-time control of the vehicle, its cameras, instruments,

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and samplers. The tether also carries images and data back to the operators above. ROVs allow for high-precision sampling, large payloads, and long-endurance missions.

- **Human Occupied Vehicles (HOVs)** carry humans, with real-time control, directly into the habitat. They are battery-powered, unconstrained, and modern HOVs are optimized for large-scale, big-picture observations. People with experience using an HOV generally agree that there is no substitute for being there yourself. This is largely because our own eyes provide binocular perception, which yields 3-dimensional vision and great depth-of-field.

Ocean resources managers must operate on the best available information

Using new technologies to explore the waters west of the Golden Gate will undoubtedly reveal significant aspects of the coastal habitat and its biota that are presently unknown. It's in our own best interests to incorporate as many dynamic aspects of this system as possible into the baseline, including behavior patterns and seasonality. Entities such as the Greater Farallones National Marine Sanctuary have worked with partners to explore these waters, to define their biological characteristics, and to find ways to help manage and protect them. Although these missions yielded significant results, much more could be achieved with sufficient funding. In addition, this exploration provides a window into our past with missions seeking to discover shipwrecks and maritime artifacts, which have accumulated in these waters for centuries. Although much has been learned through these investigations, we are just at the beginning of developing the baseline necessary to understand the marine habitats, their biota, and the archaeological resources and how our actions maybe alerting, potentially forever, this environment.

For long-term monitoring and management, it should not be necessary to repeat the full exploratory effort required to establish a baseline. Instead, measurements can be confined to certain representative sites, and principal constituent species can stand proxy for full communities. In the not-too-distant future, biodiversity may be measured from simple water samples using environmental DNA (eDNA) techniques. The relative abundances of critical species may be measured by vehicles carrying a miniaturized microbiology laboratory that can either preserve or process water samples autonomously using molecular-probe techniques. These are not pie-in-the-sky technologies—they exist now.

The Central Coast and the San Francisco Bay Area provides fertile ground for ocean exploration technology. The Monterey Bay Aquarium Research Institute (MBARI), located in Moss Landing in Monterey Bay, has a mission to achieve and maintain a position as a world center for advanced research and education in ocean science and technology, and to do so through the development of better instruments, systems, and methods for scientific research in the deep waters of the ocean. MBARI emphasizes the peer relationship between engineers and scientists as a basic principle of its operation. Deep Ocean Exploration and Research (DOER) is located in Alameda in San Francisco Bay. DOER manufactures and operates remotely operated vehicles,

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human occupied vehicles, autonomous vehicles, and other technical products. DOER supports all aspects of undersea exploration from technical design and construction, to conducting exploratory missions in ocean waters in California waters and throughout the world. Another undersea operator in San Francisco Bay is the Marine Applied Research and Exploration (MARE) located in Richmond, which, among other projects, has been conducting much of the undersea monitoring work with remotely operated vehicles in support of the State of California's system of Marine Protected Areas.

Many other entities are working on ways to improve technology for ocean exploration and for other ocean uses. For example, the Schmidt Marine Technology Partners, located on the San Francisco Bay waterfront, is supporting the development of ocean technologies with compelling conservation and research applications, as well as strong commercialization potential. Organizations such as Autodesk are looking into the evolving role of design-driven applied innovation to help address some of the most complex ocean challenges. Autodesk now has an Explorer in Residence and is conducting research, experiments, collaborations, and development in relation to ongoing maritime activities.

A Case Study in Sanctuary Waters Off the Golden Gate - Using Exploration and Science to Protect Habitat and Rebuild Fish Populations

In 2001 and 2002, National Marine Sanctuary staff and partners conducted the first submersible surveys exploring the Cordell Bank to characterize habitats and assess fish distribution and abundance on the Bank. During the course of conducting these initial surveys, abandoned entangled fishing gear was observed on 90% of the surveys that passed over hard substrate (20 out of 22 transects). Most of the gear consisted of derelict long lines but there were also several gill nets, recreational fishing line, and tangles of unidentified gear.

Many of the areas with derelict gear were also areas that supported rich assemblages of invertebrates including anemones, sponges, and hydrocoral. This invertebrate cover provides important structure that serves as nursery habitat for several species of first-year rockfishes that settle into these benthic habitats after spending their early larval period in the water column.

Sanctuary staff brought initial survey results to the attention of the Pacific Fisheries Management Council (PFMC) who, along with the National Marine Fisheries Service (NMFS), are responsible for managing commercial fisheries in federal waters along the west coast.

At that time, the PFMC was engaging in a process to identify Essential Fish Habitat along the west coast. Using information collected during these initial submersible surveys, PFMC designated the top of Cordell Bank an Essential Fish Habitat conservation area, which allowed them to establish regulations prohibiting the use of bottom contact gear in the sensitive upper Bank habitat that serves as an important recruitment area for many species of rockfish.

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The PFMC and NMFS were also in the process of trying to rebuild several rockfish populations along the west coast that had been overfished. By using information collected with these initial submersible surveys, critical habitat was protected to support ecosystem function and recovery of some overfished rockfish populations.

A Future Vision for Exploration

Aquarium of the Bay, The Bay Institute, and all the divisions of the new parent organization bay.org, intend to undertake a capital campaign to finance an upgrade of the Aquarium through the development of an Aquarium Master Plan. As a part of this Aquarium Master Plan, the Aquarium intends to broaden the scope of its Bay conservation activities to include “exploration” as a key theme to educate and inspire Bay Area stakeholders in support of the mission.

The Aquarium and The Bay Institute are collaborating with Dr. Earle and Deep Ocean Exploration and Research (DOER) on the development of an exploration program for the Aquarium with an ultimate plan to build out and operate an Exploration Hub (“Hub”) to be integrated into the structural upgrade. The Hub would be used as the operating base for one or more exploration submersibles to be procured from DOER and used by Dr. Earle in her role as Honorary Ocean Explorer, and one or more replica exploration submersibles will be procured from DOER and displayed within the Aquarium for public education and interaction. The Aquarium would seek to collaborate as much as possible on ways to use information gathered for education and to help support state and federal management activities in the region. This is an exciting vision and goal for the upcoming capital campaign.

POLICY ACTIONS FOR EXPLORATION OF SAN FRANCISCO BAY AND THE NEARSHORE PACIFIC OCEAN

Action 1: Launch a Forum To Baseline Exploration. Federal and state ocean managers, academia, the private sector, and non-profit environmental organizations are all involved in some aspect of ocean science, protection, and management of the waters and sea floor off our shores. Exploration collaborations to date beyond the Golden Gate Bridge have been productive, but have been sporadic and have not provided the coverage necessary to establish a baseline for future stewardship. The potential exists for harnessing the regional expertise and technical resources in the Central Coast and the San Francisco Bay Area to achieve that goal. What is often missing is a clear connection between exploration goals and objectives, and the needs of the state and federal trustee agencies serving as the stewards of these resources. It is time to consider the establishment of a Forum made up of government, academia, private sector, and non-profit environmental organizations to help prioritize exploration needs and to work together to support the most effective and efficient ways to explore the waters off our coast. This Forum may be something that Aquarium of the Bay’s new Exploration Hub could help coordinate if other partners are in agreement.

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Action 2: Identify and Use Modern Undersea Technology. Modern undersea technologies have reached the point where they now offer proven, cost-effective means to carry out exploration; these are the kinds of tools that should be employed. The Forum referenced above should have a goal to identify those technologies and their most appropriate applications for documenting areas that are potentially threatened and creating a baseline of knowledge of offshore resources (biological, archaeological, etc). For example, Sanctuary officials are particularly interested in the impacts of trawl gear and lost fishing gear on Sanctuary resources and would welcome enhanced attention to those issues.

Action 3: Create a Tiered Approach to Exploration. There are a variety of tools to be employed to explore the ocean's water column and floor, starting with side-scan sonar and multi-beam seafloor mapping to identify ocean features that support the greatest biological diversity. After identifying the ocean features which may support the greatest diversity and abundance of life, surveys using Autonomous Underwater Vehicles (AUVs), Remotely Operated Vehicles (ROVs), and finally Human Occupied Vehicles (HOVs) could provide finer scale data documenting the biologically richest sites and sites under the greatest threats. If threats are identified, actions can be taken to reduce and potentially eliminate these threats to vulnerable wildlife and habitats.

